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LABORATORY

UCRL-TR-235238

# Level-2 Milestone 2351:
Terascale Simulation Facility Upgrade

# Milestone report for NNSA HQ

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September 30, 2007

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# Milestone Report Introduction

This report documents the LLNL TSF upgrade ASC L2 milestone 2351: **Terascale Simulation Facility upgrade**, due Sept. 30, 2007. The full text of the milestone is included in Attachment 1. The stated goal of the milestone was:

> *Complete a 3-MW expansion of electrical power for computing systems in the east computer room of the Terascale Simulation Facility (TSF) and complete the final connection of all air handlers that were delivered as part of the TSF line item.*

In this report we detail the upgrade and cover the results of the process to accept the system by testing, adjusting, balancing and finally start-up of the system in accordance with the detailed project commissioning plan to be developed by the system engineers during the design phase of the project.

The quarterly reports for the upgrade and the text of the project commissioning plan are included at the end of this document as Attachments 2 and 3.

# LLNL TSF Upgrade Details

The 3MW expansion consisted of installing the final computational electrical capacity of the electrical distribution system in the east room to achieve an overall computational power level of 7.5MW. The scope of the project included commissioning two 13.8kV – 480/277V, 1500kVA medium voltage transformers, installing over 8 miles of secondary electrical cable from the electrical yard into the first level of the machine room for the low voltage distribution, six secondary 500kVA distribution transformers, six secondary low voltage switchboards, low voltage conduit/raceways, and 36 panelboards on the second level of the machine room. The project also included the final connection of (2) 80,000 CFM air handlers to be fully commissioned once the direct digital control system is upgraded in FY08. The air handlers are not needed to support the increase in electrical capacity, they will not come on line until FY08.

3MW of increased capacity will provide 26,280 MWh of energy annually for computational load. This available energy capability can provide enough energy to serve about 2400 average sized homes. The project was to increase the overall capability of the computational electrical capacity to TSF to site future platforms.

The secondary distribution is highly scalable and flexible and can be distributed at 480V or 208/120V. This project installed 1.5MW at 480V and 1.5MW at 208/120V. General Electric and Underwriter's Laboratory completed a certification of the

switchboards and panelboards for multi-voltage ratings. The switchgear and panelboards are now dually rated for applications at 600V and below. Both 480V and 208V electrical distribution is within the range of the multi-voltage rating application.

The 3MW expansion completed on 9/25/07 upon completion of the panelboard installation and associated inspections. The panelboards are fully energizable upon Program demand. The mechanical portion of the project (air handler hookup) was complete on 9/21/07 after final inspections. The air handler hookup is complete though not fully available until the direct digital control system is upgraded in FY08; the direct digital control system upgrade is outside the scope of this milestone.

# LLNL TSF Upgrade Acceptance Testing

The inspection and acceptance testing of the electrical power distribution equipment is performed in accordance with NETA ATS – 2007, which is an acceptance testing specification published by InterNational Electrical Testing Association. The inspection and testing procedures clearly define the following:

Scope
Applicable References
Qualifications of Testing Organization and Personnel
Power System Studies
System Function Test
Thermo graphic Survey
Expected Test Results
- Visual and mechanical inspection
- Electrical tests
- Test values

The visual and mechanical inspections are complete and are documented by the Subcontractor and verified by the Facility Management staff. The electrical tests and the compilation of the tests are in progress with an independent third party testing agency.

# Attachment #1: Milestone Definition Text

| | | | | |
|---|---|---|---|---|
| **Milestone (ID#):** Terascale Simulation Facility upgrades (#2351) | | | | |
| **Level**: 2 | | | | |
| **Fiscal Year**: FY07 | | | | |
| **DOE Area/Campaign**: ASC | | | | |
| **Completion Date**: Sep-07 | | | | |
| **ASC nWBS Subprogram**: Facility Operations and User Support | | | | |
| **Participating Sites:** LLNL | | | | |
| **Description**: Complete a 3-MW expansion of electrical power for computing systems in the east computer room of the Terascale Simulation Facility (TSF) and complete the final connection of all air handlers that were delivered as part of the TSF line item. | | | | |
| **Completion Criteria**: The completion criteria is to fully accept the system by testing, adjusting, balancing and starting-up the system in accordance with the detailed project commissioning plan to be developed by the system engineers during the project design phase. | | | | |
| **Customer**: ASC Program | | | | |
| **Milestone Certification Method**: Completion evidence will be documentation and Program hand-off. | | | | |
| **Supporting Resources**: N/A | | | | |
| **Codes/Simulation Tools Employed**: N/A | | | | |
| **Contribution to the ASC Program**: Enables the TSF to site next generation ASC capability and capacity systems. | | | | |
| **Contribution to Stockpile Stewardship:** | | | | |
| **No.** | **Risk Description** | **Risk Assessment (low, medium, high)** | | |
| | | **Consequence** | **Likelihood** | **Exposure** |
| 1 | Operations of the east computer room will be impacted during physical construction. | Medium | High | |
| 2 | The direct digital control (DDC) system commissioning of air handlers will require significant contingency planning to ensure existing operations are not impacted. | Medium | High | |

# Attachment #2: Project Quarterly Reports

The following entries were reported as quarterly reports in the ASC Site Work Plan for this project.

Due Date: FY07 Q4
Planned Milestone Budget: 22578.0

Q1

Status: Green

Progress Narrative: Q1 Achievements October - December - Successfully prioritized FY07 projects and received ranking from the Facility Governance Board (FGB) to proceed on various elements that make up the 3MW completion to the East Computer Room in B-453. - Design complete for the following 3MW projects: o T-1851 and T-1860 13.8kV - 480/277V Medium Voltage Connections o 1851A and 1860A Low Voltage Feeder Distribution o (2) 80,000 CFM Air Handler Connections – Electrical/Mechanical/Controls - Purchased (6) 500kVA secondary transformers for the 480V distribution. Scheduled to arrive April 20, 2007.

Q2

Status: Green

Progress Narrative: Q2 Achievements January - March - Design complete for the final 3MW element: o Computational Utilization Distribution and Panelboard Installation - Finalized Form 1s and Job Orders for all of the 3MW project elements. Work scheduled with Labor Only and on track to complete in middle of Q4: o T-1851 and T-1860 13.8kV - 480/277V Medium Voltage Connections o 1851A and 1860A Low Voltage Feeder Distribution o (2) 80,000 CFM Air Handler Connections – Electrical/Mechanical/Controls o Computational Utilization Distribution and Panelboard Installation - Specifications complete for the 36 panelboards for the East Room. Purchase Order in progress. - Purchase Order complete with General Electric to certify the switchboards for multi-voltage ratings.

Q3:
Status: Green

Progress Narrative: Q3 Achievements April - June
T-1851 and T-1860 13.8kV - 480/277V Medium Voltage Connections have started and the project is about 25% complete.

1851A and 1860A Low Voltage Feeder Distribution is 75% complete.

(6) 500kVA secondary transformers and associated switchgear for the secondary distribution is 95% complete.

(36) panelboards for the East Room are being installed. Conduit from switchgear to panelboards is complete ready to accept conductor installation. Entire task is 45% complete.

General Electric is in process of certifying switchboards and panelboards for multi-voltage ratings in preparation of UL inspection visit.

(2) 80,000 CFM Air Handler Connections - Mechanical connections complete and electrical distribution to begin. Project is 50% complete.

Q4:
Status: Blue

Progress Narrative: Q4 Achievements July – September

T-1851 and T-1860 13.8kV - 480/277V Medium Voltage Connections are 100% complete. Certified and inspected by Computation Facility Management staff.

1851A and 1860A Low Voltage Feeder Distribution is 100% complete. Certified and inspected by Computation Facility Management staff.

(6) 500kVA secondary transformers and associated switchgear for the secondary distribution is 100% complete. Certified and inspected by Computation Facility Management staff.

(36) panelboards for the East Room are being installed. Conduit from switchgear to panelboards is complete ready to accept conductor installation. Entire task is

100% complete. Certified and inspected by Computation Facility Management staff.

General Electric and UL are complete in certifying switchboards and panelboards for multi-voltage ratings. Certified and inspected by Computation Facility Management staff.

(2) 80,000 CFM Air Handler Connections - Mechanical connections complete and electrical distribution in progress. Project is 90% complete. Certified and inspected by Computation Facility Management staff.

# Attachment #3: Project Plan

ICCD Computation FY07 3MW Project Plan

| PFN# | FGB Tracking # | Directorate | Facility # | Title of Work | Description of Work | Comp Rank | Justification - Rationale for Need Rank/Impact if Deferred | Description of specific ES&H or security impacts | Estimated cost | Project duration | Comments | FGB Rank | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2006001 | FGB-COMP-B453-2006001 | COMP | 453 | T-1851 and T-1860 13.8kV 480/277V Connections | Connect and commission (2) spare 1500kVA, 13.8kV - 480/277V pad mount transformers in the B-453 Electrical Yard. The transformers are currently stored on their electrical pads and need to be connected to the 13.8kV sectionalizing switches. Work to be accomplished by the HV crew through the HV splicing contracts. | 1 | Extend LLNLÕs High Performance Computing (HPC) leadership by increasing the ability in siting multiple platforms. Impact of deferral will reduce the ability to site the next platform. | None | $40,000 | 60 days | Previous mortgage - transformers stored in place. Cost verified with Electric Utilities and Form 1 is in Plant Engineering and is assigned to the Electric Utilities Group(EUG). The EUG will perform this work in the summer of 2007. | 1 | Yes |
| 2006002 | FGB-COMP-B453-2006002 | COMP | 453 | 1851A and 1860A Feeder distribution | Secondary low voltage feeder distribution from (2) existing 480V switchboards to (6) new 500kVA transformers in the 1st level of the east machine room | 1 | Extend LLNLÕs High Performance Computing (HPC) leadership by increasing the ability in siting 480V platforms. Impact of deferral will reduce the ability to site the next platform. The computational vendor industry is designing more systems at 480V instead of 208V requiring our facility to be more flexible for the next generation HPC platforms. | None | $766,000 | 120 days | Previous mortgage - switchboards stored in place. Estimate received from LO, Form 1 in process with LO. Design illustrated on TSF contract drawings as "future". Ed to cloud as-built drawings by 2-23-07 for Marriann to submit to Hassan for review. Design concepts were designed and approved by Ackerman-Practicon in design of the facility. | 1 | Yes |
| 2007002 | FGB-COMP-B453-2007002 | COMP | 453 | 480V Machine Room Panelboard Installation | Furnish and install (30) panelboards in the 2nd level east machine room | 2 | Extend LLNLÕs High Performance Computing (HPC) leadership by increasing the ability in siting 480V platforms. Impact of deferral will reduce the ability to site the next platform. The computational vendor industry is designing more systems at 480V instead of 208V requiring our facility to be more flexible for the next generation HPC platforms. | None | $1,500,000 | 120 days | Design illustrated on TSF contract drawings as "future". Anna Maria to cloud as-built drawings by 2-23-07 to submit to Marriann to have Hassan review. General design concepts were designed and approved by Ackerman-Practicon in design of the facility. | 2 | Yes |
| 2006003 | FGB-COMP-B453-2006003 | COMP | 453 | (2) 80,000 CFM Air Handler Connections | Complete the air handling system connections. Furnish and install electrical, mechanical and controls to complete this project. | 2 | Extend LLNLÕs High Performance Computing (HPC) leadership by increasing the ability in siting multiple platforms. Impact of deferral will reduce the ability to site the next platform. | None | $500,000 | 180 days | This electrical and mechanical connections will be completed this FY and the control implementation will be carried over into FY08 to coordinate with DDC system updgrade to improve efficiencies and provide cost savings to the Program. The existing air handling system can handle the electrical increase. Estimate complete and Form 1 in process with LO. Design illustrated on TSF contract drawings as "future". Marriann to cloud as-built drawings by 2-16-07. Design concepts were designed and approved by Ackerman-Practicon in design of the facility. | 2 | Yes |